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New reports of the plant pathogens *Aecidium viburni* and *Erysiphe viburni* from Pakistan

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Abstract—The rust pathogen *Aecidium viburni* and the powdery mildew *Erysiphe viburni* were isolated from leaves of *Viburnum grandiflorum*, establishing new records for Pakistan mycobiota.

Key words —Abbottabad, *Ascomycota*, *Uredinales*

Introduction

Viburnum grandiflorum Wall. ex DC. (grand Viburnum), belonging to *Adoxaceae*, is one of the most common shrubs in the Himalayas between 1500–3000 m altitude. The flowers often bloom soon after the leaves have fallen in November and continue to appear until June. While the flowers are sweet-scented, the leaves emit a bad smell when bruised. This plant is considered economically important because of its sweet edible fruits. Seed juice is used for treating typhoid and whooping cough (Malik & al. 2011). Ripe fruits are eaten raw and stems are used as fuel (Rana & al. 2014). Leaves and fruits are given to cattle for constipation and fruits are used to treat stomachache. The bark is used to make ropes (Amjad & Arshad 2014). This economically important plant is considered to be stressed by various fungal pathogens. In the present study, we identified two fungal species infecting *V. grandiflorum: Aecidium viburni* and *Erysiphe viburni*. Both species represent new records for Pakistan.

Materials & methods

During field surveys of Himalayan forests in Abbottabad and Swat districts, Pakistan, leaves of *Viburnum grandiflorum* were found infected with two fungal pathogens. The infected specimens were preserved and photographed both in the field and under a Meiji EMZ-5TR stereomicroscope. Free hand sections were cut, and scrape mounts of infected portions were observed. Twenty–twenty-five spores from each spore state were examined under the Nikon YS 100 compound microscope and measured at 400× using a ScopeImage 9.0(X5).exe. Sections and spores of the rust fungus and the powdery mildew hyphae, chasmothecia, asci, and ascospores were photographed with a Digiporo-Labomed camera and illustrated using a Leitz camera lucida. Spore surface ornamentation was observed using Scanning Electron Microscopy (SEM) with EDX. For correct identifications we consulted experts, previously published literature (Braun & Cook 2012; Hiratsuka & al. 1992), the U.S. National Fungus Collections Literature Database (https://nt.ars-grin.gov/), and Index Fungorum (www.indexfungorum.org/). Field specimens were deposited in the Herbarium, Department of Botany, University of the Punjab, Lahore, Pakistan (LAH).

Taxonomy

Aecidium viburni Henn. & Shirai,
Bot. Jahrb. Syst. 28(2): 265 (1900) PLS 1, 3A,B, 4A–C

Spermogonia adaxial, group 1, type 1, yellowish brown, 86–113 µm diam. Aecia adaxial, densely gregarious, brown to dark brown lesions, irregular. Aeciospores globose, subglobose or ellipsoid, hyaline to subhyaline, 18–23 × 20–25 µm, wall densely verrucose, 2.5–3.6 µm thick. Peridial cells hyaline, angular to nearly rhomboid, 16–23 × 21–25 µm, wall verrucose, ≤2 µm thick.

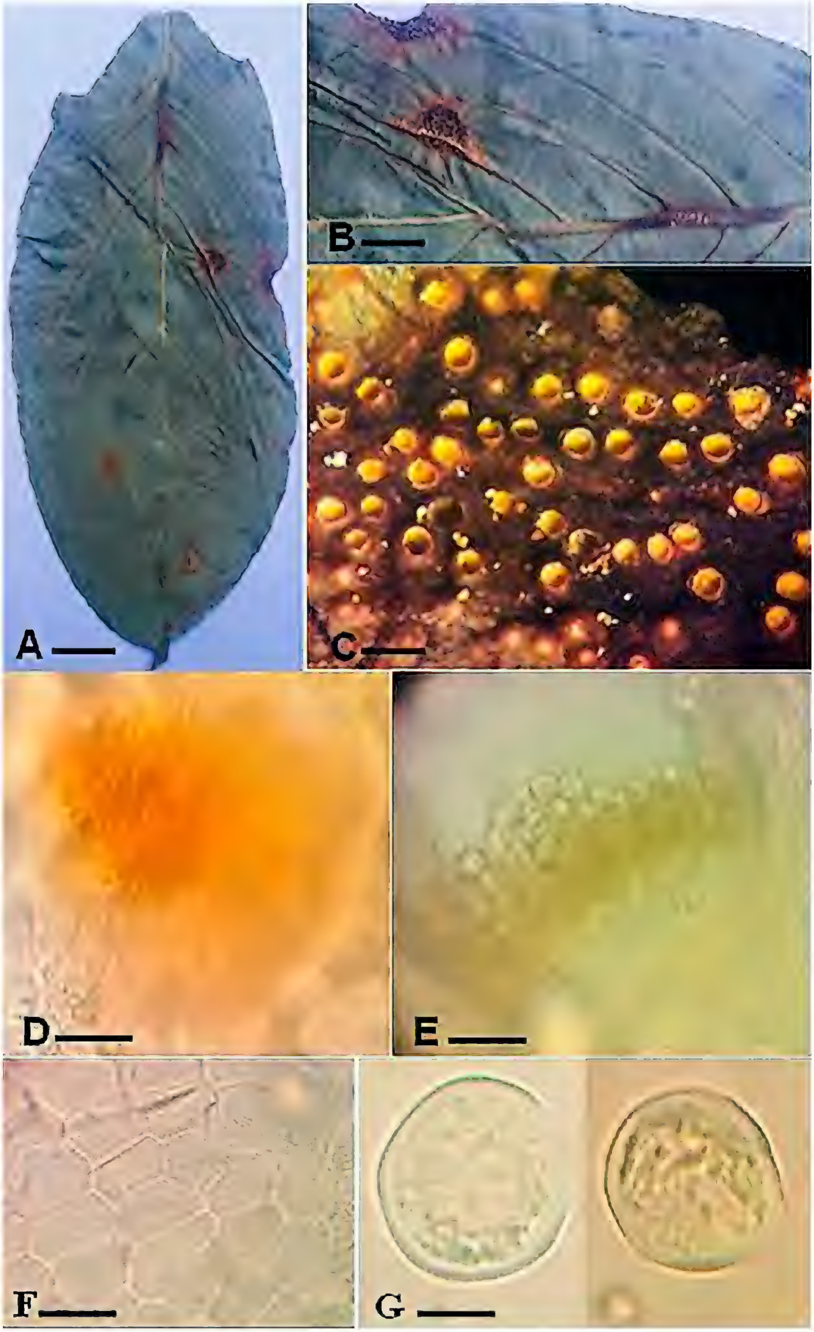
SPECIMEN EXAMINED: **PAKISTAN, KHYBER PAKHTUNKHWA, Abbottabad district**, Khanspur, at 2250 m asl, on living leaves of *Viburnum grandiflorum*, stages 0 + I, 1 July 2015, A. Ishaq KP-50 (LAH-AM20002).

COMMENTS—Previously reported on various *Viburnum* species from China, Japan, Korea, and Russia (Siberia) (Farr & Rossman 2017). *Aecidium viburni* is reported for the first time from Pakistan, and this is the first record of *Viburnum* as a rust host in Pakistan.

Erysiphe viburni Duby, Bot. Gall. 2: 872 (1830) PLS 2, 3C–G, 4D–F

Mycelium amphigenous, effuse or in patches; hyphae hyaline, smooth; chasmothecium scattered to almost gregarious, globose, dark brown, 90–115 µm

PLATE 1. ***Aecidium viburni*** (LAH-AM20002). A–C. Infected host plant. *Viburnum grandiflorum*; D. Spermogonium; E. Aecium with chains of aeciospores; F. Peridial cells; G. Aeciospores. Scale bars: A = 0.8 cm; B = 1 cm; C = 1 mm; D, E = 20 mm; F = 13.5 µm; G = 9 µm.


A
B
C
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G

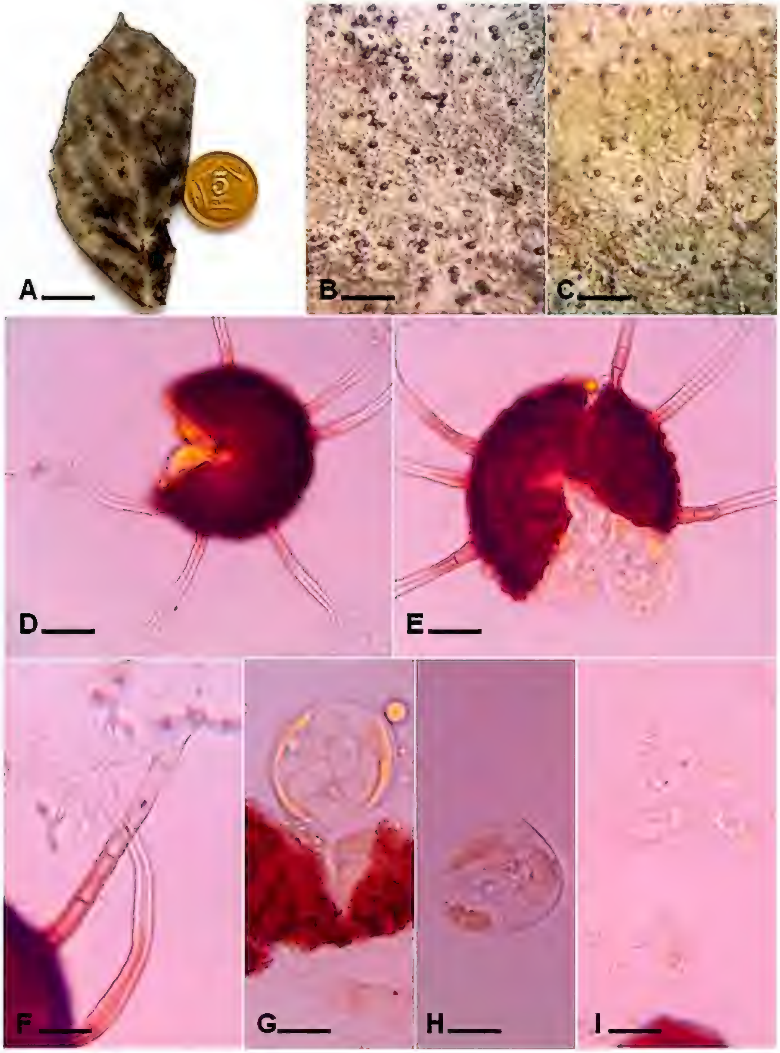

Plate 2. ***Erysiphe viburni*** (LAH-E0001). A–C. Infected host plant *Viburnum grandiflorum*; D. Chasmothecium with dichotomous appendages; E. Broken chasmothecium with asci; F. Apical part of appendages; G, H. Ascus with ascospores; I. Mature ascospores. Scale bars: A = 1.7 cm; B, C = 1 mm; D = 28.5 µm; E = 24 µm; F, G = 18 µm; H, I = 19 µm.

diam.; peridial cells not conspicuous, small, irregularly shaped; appendages 6–8 in number, equatorial, stiff, mostly curved, 0.8–1.2 times as long as the chasmothecial diameter, about 7–9 µm wide, dichotomously branched,

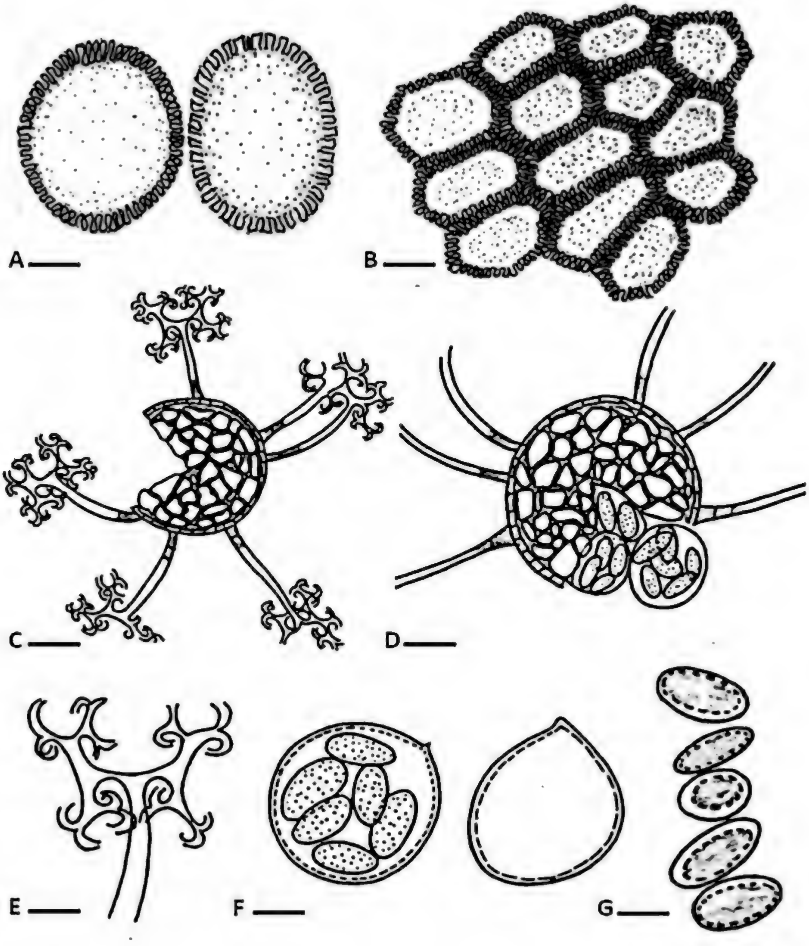

Plate 3. ***Aecidium viburni*** (LAH-AM20002). A. Mature aeciospores, B. Peridial cells. ***Erysiphe viburni*** (LAH-E0001). C. Chasmothecium with dichotomous appendages, D. Broken chasmothecium with asci, E. Dichotomous appendage showing curved tips, F. Asci with ascospores, G. Ascospores. Scale bars: A = 6 µm; B = 9 µm; C = 40 µm; D = 27.5 µm; E = 15 µm; F = 16.5 µm; G = 8 µm.

aseptate or with 1–2 septa at base, hyaline but pigmented at base, walls rough, moderately thickened throughout or thin above and thick towards base; at apex branched 4–5 times, regularly and densely dichotomously, tips distinctly recurved; asci 1–3, globose to ovoid, 43–61 × 37–53 µm, sessile

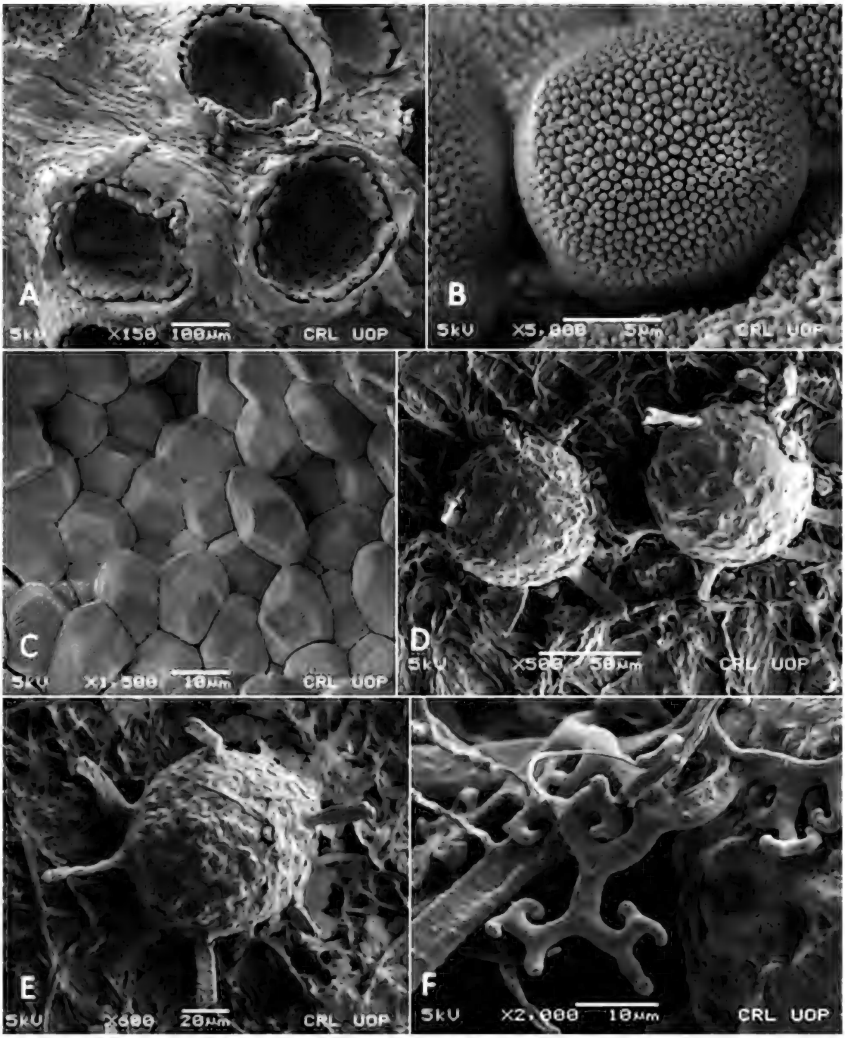

Plate 4. ***Aecidium viburni*** (LAH-AM20002). A. Aecium; B. Aeciospore showing verrucose surface ornamentation; C. Sterile peridial cells. ***Erysiphe viburni*** (LAH-E0001). D, E. Chasmothecium; F. Apical part of dichotomous appendages.

or rarely short-stalked, 6–8 spored; ascospores globose–ellipsoid to ovoid, 16–27 × 11–16 µm, hyaline.

Specimen examined: **PAKISTAN**, **Khyber Pakhtunkhwa**, **Swat district**, Swat, Malam Jabba, at 2250 m asl, on living leaves of *Viburnum grandiflorum*, 11 August 2017, A.N. Khalid & A.R.K. Niazi SS #4 (LAH-E0001).

COMMENTS: *Erysiphe viburni* is a new record for Pakistan. The species has been previously reported on many *Viburnum* species and some members of *Adoxaceae* from Central Asia and China (Cao & al. 2000); India, Japan, Korea (Cho & Shin 2004); and Russia (Far East, Siberia), North America (Canada, USA), and Europe (Braun & Cook 2012).

Erysiphe viburni is distinguished from *E. hedwigii* and *E. miranda* by its larger chasmothecia.

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